MICROSCOPY.[1]

RECOGNITION OF WOOL IN MIXED FABRICS. — Any child at all familiar with the instrument can instantly distinguish wool from cotton, linen, and silk, as figured in the common books on the microscope; but the exigencies of modern commerce have developed new and difficult questions in regard to the diagnosis of wool. The Treasury Department of the United States, after having from June, 1870, down to February, 1875, admitted certain fabrics, known as "calf-hair goods," free from those duties which would be levied upon goods composed in part of woolen fibres, on certificate from the manufacturers of such articles that they were made entirely of cow-hair, calf-hair, and vegetable fibres, and contained no wool or worsted in any form, became possessed of strong evidence that these fabrics were not made, and could not be made, wholly without wool, and submitted the question to the National Academy of Sciences for investigation, furnishing more than ninety samples of these goods as materials for study. Drs. J. J. Woodward and J. L. Leconte were appointed a commission to investigate the subject, and at their request Drs. J. G. Hunt and E. M. Schaeffer made a careful microscopical examination of the samples furnished, and also, for comparison, of different varieties of commercial wool and of hair from different animals, and prepared mounted samples of each for further study and comparison. The fibres, having been rendered opaque by the dyestuffs previously employed, were bleached in dilute mineral acids, mounted in glycerine, and examined mostly with powers of from $\frac{1}{2}$ to $\frac{1}{5}$ inch, except for estimating percentages, for which lower powers were employed. In a few of the samples submitted no wool was found, or only doubtful hairs, or a few fibres, not certainly indicating an intentional admixture. In a larger proportion of cases there was not much wool, while in a very large number of samples there was from five and ten per cent. to a much larger proportion; in one case it being difficult to find five per cent. of genuine cow-hair.

As a result of these observations, and of a subsequent verification of them, the commission submitted to the Secretary of the Treasury a report which contributes largely to the clearness of our knowledge of the relations of wool to other kinds of hair, and which is published, with excellent heliotype illustrations, in the Bulletin of the National Association of Wool Manufacturers, December, 1875.

While it is remembered that some microscopists deny the possibility of distinguishing the hair of the cow and calf from that of the sheep, and that others differ among themselves as to the result of observations on the same samples, and while it is admitted that both kinds of hair are of a very similar structure in respect to the arrangement and details of their medullary, cortical, and cuticular portions, it is still confidently asserted

[1] Conducted by DR. R. H. WARD, Troy, N. Y.

that true wool can be reliably detected by the microscope in mixtures where it occurs. The kinds of hairs observed and described by the commission, may be conveniently arranged in three groups. First, wooly hairs. These mostly extend "from half an inch to several inches in length, without any medulla, and without perceptible taper. They present (especially in the wool of the sheep), at frequent but irregular intervals, well-marked, one-sided, more or less spirally arranged thickenings of the cortical substance, which gives to the wool its curly character. The mean diameter of each hair varies from $\frac{1}{500}$ to the $\frac{1}{1000}$ of an inch, or even less; and the scales of the cuticle are so arranged that their free edges project somewhat, forming well-marked imbrications, of which usually from fifteen to thirty can be counted in the $\frac{1}{100}$ of an inch." Such hairs constitute the wool of commerce, originally limited to the sheep but now applied to the goat, camel, and llama, and similar hairs have long been known to be mixed with the straight hair of various animals, such as the "deer, hare, rabbit, beaver, otter, seal, lion, tiger, certain varieties of dog, and some foreign breeds of oxen." All these hairs are so much alike, structurally, that it is believed they should all be designated as wool, and it is not claimed that the animal from which they were derived can be uniformly and reliably determined by the microscope. Obviously some of these varieties not now recognized as wool might in the future become of sufficient commercial importance to require either the legalization of them all as "wool," or the discovery of more complete methods of discrimination. Second, straight hairs. These are often shorter, "much thicker at their base, and taper rapidly towards the point. The medulla occupies a large proportional part of the whole hair, and the free edges of the scales of the cuticle, which are so disposed as to form from twenty to forty imbrications to the $\frac{1}{100}$ of an inch, lie quite smoothly upon the surface of the hairs, so that their contours, as seen under the microscope, closely approximate continuous lines. These characters are so well marked that the coarser hairs of the cow and calf can readily be distinguished from the woolly hairs of any of the wool-bearing animals." Naturally mixed with the wool of the sheep, however, especially with the inferior grades, and with that of the goat, forming the "outer coat" of the goat, are coarse, straight hairs, so closely resembling some of the hairs of the cow or calf that their discrimination presents great difficulties; and such hairs, even when derived from the wool-bearing animals, cannot be recognized as wool by the microscope. The percentage of "wool," therefore, as determined in mixed fabrics, by a microscopical count of hairs, would probably be underrated in a certain proportion of cases. In case all woolly hairs which are "more or less crispy, curled, or frizzled" should be legalized as wool, it would probably be convenient to make an exception, admitting as genuine wool such a percentage of straight hairs as is found to be present in a specified quality of the sheep's coat. Third, doubtful hairs. Among the imbricated hairs

of the wool of the sheep some are occasionally found which so closely resemble the softer hairs of the cow or calf that the investigators confess themselves unable to discriminate between them in all instances. Hairs of this description are therefore more properly classed as doubtful, than included in either of the other groups.

Animal and Vegetable Cellulose and Starch. — Mr. Thomas Taylor has contributed to a late Monthly Report of the Department of Agriculture some interesting experiments by which starch-like bodies are artificially produced. On a fibre of cotton is placed a drop of a strong, amber-colored tincture of iodine, followed by a drop of commercial muriatic acid, and immediately afterwards by a drop of concentrated sulphuric acid. The combination of the sulphuric acid with the water of the muriatic causes the liquid to boil for two or three seconds, and the cellulose or cotton fibre is changed, as shown under a power of about one hundred diameters, into the form of disks or beads of a well-defined blue color. A similar change can likewise be produced in flax, and in a variety of vegetable tissues. Fresh animal tissues yield a somewhat similar result, brain, heart, liver, muscles, etc., having been successfully experimented upon. Fibrine of blood, both human and bird's, dissolved in caustic potash and precipitated by acetic acid, gives well-characterized granules, a result which is confirmed by hundreds of experiments.

Arranged Pollens. — Mr. J. A. Langstroth has presented to the San Francisco Microscopical Society slides having pollen from different species of flowers, arranged on the same slide for convenience of comparative study.

Effect of Aperture on Definition. — Mr. J. Zentmayer, in a very clear lecture on the elementary properties of lenses, published in the *Journal of the Franklin Institute*, May and June, 1876, calls attention prominently to the confusion of images necessarily attendant upon large apertures, except when viewing absolutely flat objects, from the stereoscopic character of the images formed by different portions of the surface of the lens, the image formed by pencils transmitted by one side of the lens being unavoidably different from corresponding images formed by the opposite side of the lens.

Microscopical Examination of Crude Drugs. — Prof. M. W. Harrington, whose well-known success in this branch of study gives interest to any production for which he is responsible, being not yet ready to publish his work on the Identification of Vegetable Drugs, Foods, and Fibres, has caused the publication in pamphlet form (by John Moore, publisher, Ann Arbor, Mich.) of the Introduction and Analytical Tables with which the book will be furnished. The brief introductory part contains a few excellent general suggestions in regard to this kind of work, while the analytical tables are a novel and able application of the methods of the artificial keys of modern works on botany to this field of microscopical research. The tables are published now, and in this form,

partly for convenience in class use in teaching, and partly that they may, by the test of practical use, receive any necessary corrections or additions before the publication of the full work.

APERTURE OF OBJECTIVES. — Mr. F. H. Wenham's experiments with the slit as a means of cutting off the lateral rays of an objective have led him to announce the belief, in the *Monthly Microscopical Journal*, that an excessive or false aperture is attributed to all objectives by the lateral pencils which direct light far beyond the axial one, and thus greatly enlarge the diameter of the proper light disk. An aperture mapped out on a screen shows the false aperture faintly portrayed as an outer circle of light, while the true aperture, as obtained by the slit, gives a bright, oval disk within the other. As an example of the effect of the slit in reducing to what he regards as the true aperture, he mentions the following reduction of the nominal angles of three lenses made nearly twenty years ago: a $\frac{1}{5}$ of 100° to 56°, a $\frac{1}{8}$ of 130° to 92°, and a $\frac{1}{12}$ of 170° to 100°. He invites discussion upon this novel and very interesting question, which ought to excite the greatest attention until settled beyond dispute.

Mr. Wenham now uses a slit of fixed width, cut through an opaque film upon a glass slip 3x1, being substantially the method contrived by Mr. Tolles, and published in the NATURALIST for March, 1875. He also adopts without credit Mr. Tolles' plan of covering the slit with a balsam-mounted thin cover-glass, so that the objective can be adjusted and tested under natural conditions.

PHOTOGRAPHING THE NINETEENTH BAND. — Count Castracane has photographed, apparently successfully, Nobert's nineteenth band, with an amplification of eight hundred diameters obtained by means of a Gundlach dry lens of $\frac{1}{3}$ German inch focus. The object was illuminated by an achromatic condenser of large angle, and with a large central stop. The resolution of this band of lines of $\frac{1}{112320}$ inch by a dry lens, has not been generally deemed possible heretofore. The genuineness of the photographic lines was established by micrometric measurement. This success, if reliable, seems an invasion of Helmholtz's theory on the ultimate limits of microscopic power; but such theories seldom live long.

POPULAR MICROSCOPY. — The increasing use of the microscope among persons of previously unscientific habits and education is nowhere better shown than by the demand for what is called a popular method of treating the subject in books and journals. Mr. John Phin's little book on the Selection and Use of the Microscope, intended for beginners, in which the subject is simplified and rendered elementary to a greater extent than ever before in a really scientific work, was so well received as to lead, apparently, to the establishment of a periodical, the *American Journal of Microscopy*, a monthly magazine published in the same spirit and under the same management.

AN EASY NITZSCHIA. — The No. 19 of Möller's test plate, resolved

into beads by the Nachet No. 5 objective of the San Francisco Microscopical Society, proves to be an anomalously easy shell. The objective fails on No. 19 of other slides by the same maker. Mr. Hyde is of the opinion that the resolved shell is a true *Nitzschia curvula*, although so exceptionally easy that it is resolved by any good $\frac{1}{5}$.

Collecting Diatoms. — Much of the difficulty of making reasonably clean collections of diatoms may be obviated by using Mr. John Redmayne's method, which is described in *Science-Gossip*. A wide-mouthed bottle is attached to a cane in the usual manner, but instead of being open it is closed by a tightly fitting cork, through which are passed two glass tubes, terminating near the bottom of the vial. Externally one of these tubes is slightly bent sideways, so that its outer end can be easily approximated to a deposit of diatoms at the bottom of the water, while the other tube is bent at right angles immediately above the cork, and joined to a flexible rubber tube, which extends up to the handle of the cane. By compressing the rubber tube against the cane with the thumb of one hand, the bottle can be readily brought empty into position, when the calibre of the tube is restored by removing the thumb, and the pressure of water forces air out and water in, carrying the desired objects with it. Should the water be too shallow to afford enough pressure, suction at the upper end of the flexible tube may be employed to exhaust the air, and thus secure a rush of water into the bottle, a glass tube or ball pipette serving as a mouthpiece.

If too muddy, the gathering may be further cleaned by placing it in a long bottle, the bottom of which is covered with black paper. Thus arranged, and placed in the sunlight, the diatoms will soon free themselves from the mud and rise to the surface of the water.

Micro-Photography. — Dr. Edward J. Gayers, of Calcutta, in his work at micro-photography takes his position near the microscope where it and the illuminating reflector can be manipulated with the greatest ease, while the image on the focusing screen is examined with a small telescope consisting of a large opera-glass objective and a microscopical ocular.

Water Analysis. — While there is still great doubt as to the exact influence or significance of forms perceptible by the microscope in drinking-water, there is no doubt a very general interest in studying and recognizing these forms. In such study good use may be made of Dr. J. D. Macdonald's work on Water Analysis, in which a large number of the more common forms of mineral and organic constituents are figured in rather crude but very suggestive and natural-looking pen-sketches, which are better as a means of recognition than the elaborate and flattering steel-engravings often used. Accompanying the drawings is a good synopsis of the subject in a few pages of print, which will be convenient even to those who have access to libraries of more elaborate works.

PRACTICAL HISTOLOGY. — A good hand-book for students in the histological laboratory is the little publication of Outlines, by Dr. Rutherford, first issued in a journal some years ago, and lately enlarged and improved in an interleaved edition for laboratory use.

SCIENTIFIC NEWS.

— Near Gilroy, California, is a rose-tree of the cloth-of-gold variety twelve years old, the stock of which is *seventeen* inches in circumference, and, though closely pruned, the branches spread five feet on every side of the trunk.

— In the museum of the California Academy of Sciences is a transverse section of a lemon verbena six inches in diameter. The wood is fine-grained, of a greenish-yellow color, and takes a good polish.

— Our readers may remember a statement by Professor Snow in the NATURALIST, ix. 665, to the effect that the female of the white pelican has a horny crest on the mandible as well as the male. Mr. George B. Sennett, of Erie, Pa., writes us that in two females shot in Grant Co., Minn., the crest was as perfect in proportion to the size of the bill as in the males.

— Mr. James T. Gardner, at present Secretary of the American Geographical Society, has been appointed director of a proposed Geographical Survey of the State of New York.

— A Monograph of the Phalænidæ or Geometrid Moths of the United States, by A. S. Packard, Jr., forms vol. x. of the final reports of the United States Geological Survey of the Territories, F. V. Hayden in charge. Although a formal notice of this work would for obvious reasons not be in place in this journal, the author would beg leave to call the attention of naturalists to matter contained in the introductory portion, especially to the chapters entitled Comparative Anatomy of the Head, Comparative Anatomy of the Thorax, Development of the Thorax of the Imago, Secondary Sexual Characters of the Imago, and to the essay on Geographical Distribution. The imagines of about four hundred species and the early stages of some are described and figured.

— Professor Huxley, who is now on a short visit to this country, will deliver three lectures in New York September 18th, 20th, and 22d, on the "Direct Evidence of Evolution," and also give an address at the opening of the Johns Hopkins University.

— It is well to signalize the close of a great work which has been in progress for twenty-five years, — the *Genera des Coléoptères* of Lacordaire and Chapuis. The work was first assigned to Lacordaire of Belgium and Carreño of Spain; Carreño, however, died before the plan of the project was definitely settled, and Lacordaire undertook it alone. The first volume was published in 1854. At the death of Lacordaire, in 1870, Chapuis took his place, and has now completed the work, which